

*Conservation Assessment
for
The Kentucky Crayfish (*Orconectes kentuckiensis*)*



USDA Forest Service, Eastern Region

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This Conservation Assessment was prepared to compile the published and unpublished information on the subject taxon or community; or this document was prepared by another organization and provides information to serve as a Conservation Assessment for the Eastern Region of the Forest Service. It does not represent a management decision by the U.S. Forest Service. Though the best scientific information available was used and subject experts were consulted in preparation of this document, it is expected that new information will arise. In the spirit of continuous learning and adaptive management, if you have information that will assist in conserving the subject taxon, please contact the Eastern Region of the Forest Service – Threatened and Endangered Species Program 310 W Wisconsin Avenue, Suite 580 Milwaukee, Wisconsin 53203.

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EXECUTIVE SUMMARY

The Kentucky crayfish, *Orconectes kentuckiensis*, was first described by Rendall Rhoades in 1944. The species has a limited range in the lower Ohio River Valley, where it occurs in southeastern Illinois and western Kentucky. It occurs in shallow regions with large gravel/cobble substrates in small to large streams. Threats to the species' continued existence include habitat alterations such as gravel/cobble removal and the damming of flowing waters, and the introduction of non-native crayfish species. The species receives some protection under the Illinois Endangered Species Protection Act and Kentucky Forest Conservation Act.

NOMENCLATURE AND TAXONOMY

With the exception of five species that occur in the Pacific Northwest, all North American crayfish species belong to the family Cambaridae. The family Cambaridae is the largest of the three currently recognized families of freshwater crayfishes and of its roughly 400 species, 99% occur in North America. Described by Rhoades (1944), *Orconectes kentuckiensis* was placed in the subgenus *Rhoadesius* by Fitzpatrick (1987). Fitzpatrick proposed a subgeneric classification system for the genus *Orconectes* and assigned all members of the genus into one of ten subgenera on the basis of reproductive structure morphology. The only other member of the subgenus *Rhoadesius* is *O. sloanii* (Fitzpatrick, 1987). Males members of the two species assigned to the subgenus *Rhoadesius* possess a form I pleopod with short (less than 20% of total length of pleopod) terminal elements that are weakly arched caudally.

DESCRIPTION OF SPECIES

Orconectes kentuckiensis is a relatively small species of crayfish, rarely exceeding 35 mm in carapace length (measured from posterior edge of carapace to anterior tip of rostrum). The species has a deeply excavated rostrum with distal halves of margins straight and slightly converging, proximal halves slightly convex; margins terminating in spines. Acumen equal to or slightly longer than width of rostrum at marginal spines. Areola of moderate width, with room for 3 to 5 punctations across narrowest part. Antennal scale widest just distal to midpoint. Chelae large with moderately long fingers, dorsal surfaces usually covered with short setae. Dorsal surfaces of fingers of chelae with well developed longitudinal ridges. Mesial margin of palm of chela and moveable finger with strong tubercles, mesial margin of moveable finger slightly convex in larger individuals, mesial margin of palm with two or three rows of tubercles. Males with significantly longer chelae than females of the same carapace length (Boyd and Page 1978). Gonopod of form I male terminates in a short, laterally flattened, corneous central projection. Central projection arched caudodistally, distal tip of which is truncated and flat. Mesial process not corneous, shorter and arched more caudodistally than central projection, distal tip pointed.

The overall color of *Orconectes kentuckiensis* is somewhat variable, being light brown to tan. Dorsal surfaces of abdomen, tail fan, and cephalothorax irregularly mottled with darker brown flecks and/or patches. Caudal margin of cephalothorax with brown saddle that extends forward to just posterior of midpoint of lateral surfaces of the cephalothorax. Saddle extends posteriorly to dorsal surface of first abdominal segment. Dorsal surfaces of chelae sometimes with dark brown flecks, fingers always with orange tips followed proximally by wide black or dark brown bands.

LIFE HISTORY

A detailed life history study of this species was conducted by Boyd and Page (1978) in southern Illinois. Given the geographic proximity of their study site, we believe that life history parameters reported by them are applicable to Kentucky populations. As such, the following information is taken from that publication. Mating in *O. kentuckiensis* was observed in October and November. Ovigerous females were collected in March and April; the number of eggs carried by females increased significantly with an increase in carapace length and egg diameter averaged 1.9 mm. Form I males occurred from July through April. Form I's reverted to form II in April and May and molted back to form I in July. Most individuals lived for two years with a small percentage of the population surviving for a third year; reproductively mature first year males and females were encountered in the fall months of September and October. The species had a 1:1 sex ratio and fed on vascular plants, amphipods, isopods, crayfishes, caddisflies, and midges. Growth of individuals occurred mostly in the spring and summer months.

In Kentucky, form I males of *O. kentuckiensis* have been collected from August to May while ovigerous females have been collected in April and May.

While not reported for *O. kentuckiensis* in Boyd and Page (1978), the following life-history aspects most likely applies to the species given the lack of variation in Cambarid life cycles (Hobbs III, 1991). On average, females carry their eggs for three to four weeks, with the release of juveniles most likely occurring in April and May. Since female crayfishes are known to store viable sperm for several months, fertilized eggs carried by females may be from copulations that occurred either the previous fall or only a few weeks prior to extrusion. Females will only raise a single clutch of eggs per season. New evidence also suggests that female crayfishes in the genus *Orconectes* may mate with multiple partners and carry offspring sired by more than one male (Walker et al. unpublished data).

HABITAT

Orconectes kentuckiensis is most common in small to large streams ranging in width from 2 to 8 m with bottom substrates of cobble or large gravel. In these streams the species can usually be found under the cobble or gravel. While Page (1985) reported the species almost exclusively from rocky pools, the author has found that in Kentucky it occurs most commonly in flowing riffles averaging 0.4 m in depth. The Kentucky

crayfish has also occasionally been collected from woody debris piles in mud bottom streams (Rhoades, 1944).

DISTRIBUTION AND ABUNDANCE

The Kentucky Crayfish occurs in the lower Ohio River drainage in extreme southeastern Illinois and western Kentucky (Fig. 1). In Illinois, the species is historically known to only occur in Big, Hosick, and Peters creeks; three direct tributaries of the Ohio River in Hardin County.

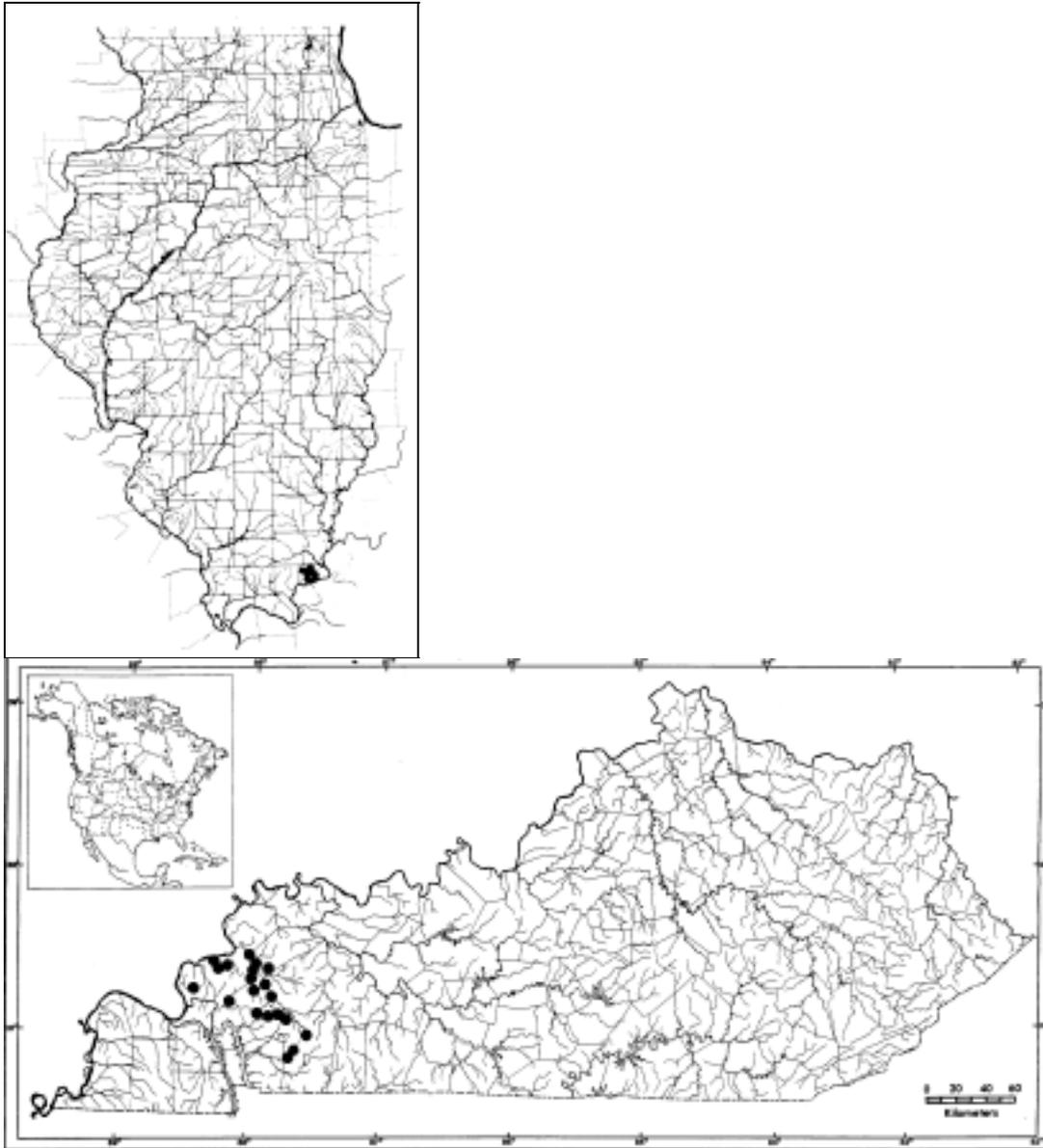


Figure 1. Range of the Kentucky crayfish, *Orconectes kentuckiensis*, in Illinois and Kentucky. Illinois map from Page (1985).

In Kentucky, the Kentucky crayfish is more widespread. It is known to occur in the Tradewater River drainage from its headwaters in Christian Co. to near its mouth on the Ohio River in Union Co. The species also occurs in the Cumberland River drainage, inhabiting Sinking Creek (Christian Co.) and Livingston Creek (Caldwell Co.) and in several direct Ohio River tributaries in Crittenden and Livingston counties.

Range-wide abundance values for the Kentucky crayfish are not available. Site specific abundance values indicate that the species can occur commonly at sites with suitable habitat. At a site on the Tradewater River, Caldwell Co. KY, 17 specimens were collected on 27 August 1997. At a site on Livingston Creek, Caldwell Co., KY, more than 30 individuals were collected on 20 April 2001. Boyd and Page (1978) reported abundance values ranging from 0.7 to 8.8 individuals per m² at three sites on Big Creek, Hardin Co., IL in 1974 and 1975. Boyd and Page (1978) also collected more than 50 individuals from single sites on Big Creek on several occasions.

STATUS

The overall status of the Kentucky crayfish appears to be stable. In Kentucky, collections made by the author (Taylor and Schuster, unpublished data) from 1997 to 2001 indicate that the species still occurs commonly in its historical range. In Illinois, the Kentucky crayfish continues to persist in Big Creek. The species has been collected from that stream on several occasions over the past 5 years (Illinois Natural History Survey Crustacean Collection Database). The status of populations inhabiting Hosick and Peters creek in Illinois is unknown.

In Illinois, the Kentucky crayfish is listed as State Endangered by the Illinois Endangered Species Protection Board (IESPB, 1999). Its listing as Endangered is due mainly to its limited distribution in the State. The State of Kentucky does not officially recognize any conservation status for crayfishes.

POTENTIAL THREATS

The primary threats to the continued existence of the Kentucky crayfish fall into two main categories, habitat alteration and the introduction of non-native species. Currently, there are no known diseases that could adversely affect the Kentucky crayfish nor is there a high likelihood that overutilization for commercial, recreational, scientific, or educational purposes could occur.

Habitat alteration

Habitat alteration can take many forms, several of which have and potentially could affect the Kentucky crayfish. While toxicological data pertaining to the effects of pollutants on the Kentucky crayfish is nonexistent, circumstantial evidence suggests that other species in the genus *Orconectes* are sensitive to water quality changes. Page (1985) reported that strip-mine and oil-field runoff and pollution may have contributed to the

extirpation of several populations of the Indiana crayfish, *O. indianensis*, in Illinois. With this in mind, it seems prudent to assume that large influxes of pollutants into streams inhabited by the Kentucky crayfish would be detrimental to it.

As the Kentucky crayfish occurs in stream habitats with coarse substrates such as gravel and cobble, water quality pollution in the form of siltation and stream channelization/debris or substrate removal pose additional threats. The species uses the spaces under rocks and woody debris for refuge from predation. These spaces would be made unavailable if overlaid by high levels of silt. Poor agricultural techniques and/or the removal of riparian buffer strips along stream margins represent the greatest source of increased silt loads in streams containing *O. kentuckiensis*. The removal of woody debris through activities aimed at improving watershed drainage and the removal of bottom substrates by instream gravel and cobble mining could adversely affect the species. As mentioned above, the species uses woody debris and cobble for refuge. Removal of such habitat components would significantly increase predation rates.

The final category of habitat alteration that represents a threat to the Kentucky crayfish is stream impoundment. The species occurs exclusively in flowing streams. While the species is occasionally encountered in slower flowing pools of streams, faster flowing riffle habitat is always found in adjoining stream reaches. Conversion of long stretches of lotic habitat to lentic conditions through stream impoundment would render that habitat uninhabitable by the Kentucky crayfish. In addition to a fundamental change in habitat structure, stream impoundment could alter suitable Kentucky crayfish habitat by increasing benthic silt loads and providing more suitable habitat for crayfish predators, mainly centrarchid sunfishes. If large enough for recreational fishing, the construction of reservoirs on streams containing the Kentucky crayfish could also substantially increase the risk for non-native crayfish introductions (see below).

Non-native introductions

The impact of non-native crayfishes on native crayfish species has been substantial and overwhelmingly negative (Lodge et al., 2000). In North America, there are numerous documented examples of the effects of non-native crayfishes (Lodge et al., 2000), with most examples involving the rapid displacement of native crayfish species. In northern Wisconsin the introduction of the rusty crayfish, *Orconectes rusticus*, has led to a greater than 50% reduction in the number of native populations of the virile crayfish, *O. virilis*, with some populations being entirely eliminated (Lodge et al., 2000; Olsen et al., 1991).

The same situation is also occurring in northern Illinois; however, in that region the native northern clearwater crayfish, *Orconectes propinquus*, is being rapidly displaced by *O. rusticus* (Taylor and Redmer, 1996). Non-native crayfishes can also carry pathogens harmful to native species. In Europe, *Pacifastacus leniusculus*, a species native to northwestern North America, has been responsible for the spread of the fungal crayfish plague *Aphanomyces astaci*. The crayfish plague, endemic to North America species and

lethal to European species, has reduced populations of native European crayfish species by as much as 90% in some regions (Lodge et al., 2000).

Several mechanisms by which non-native crayfishes displace natives have been elucidated. Those include competition, predation, and reproductive interference (Lodge et al., 2000; Perry et al., 2002). In North America, the most common pathway for the introduction of non-native crayfishes has been through their use as fishing bait. Other pathways that have been documented in North America and abroad include legal and illegal stocking, aquaculture escape, and aquarium and pond trade escape (Lodge et al., 2000).

LAND OWNERSHIP AND EXISTING HABITAT PROTECTION

In Illinois, a significant portion of the Kentucky crayfish's range occurs on land under the ownership of the United States Department of Agriculture Forest Service, falling within the Shawnee National Forest. Upstream of the Township 12 south, Range 8 east, section 8 and 9 boundary line across Big Creek (Hardin Co.), the USDA owns most of the land over which Big Creek and its tributaries flow. This includes Goose and Hogthief creek, both of which are known to harbor populations of the Kentucky crayfish. The remainder of the land within the Big Creek drainage is in private ownership. The species is also known to occur in the Hosick and Peters creek drainages. The USDA owns land abutting Hosick Creek for approximately 1/2 mile (1 mi N Elizabethtown, Hardin Co.; T12S, R8E, sec. 22) and approximately 1/16 square miles of land over which Peters Creek flows (1 mi SW town of Peters Creek, Hardin Co., IL; T12S, R9E, sec. 18).

Kentucky crayfish habitat that falls within the Shawnee National Forest receives protection under the Amended Land and Resource Management Plan (USDA FS, 1992). Under that Plan, the Forest Service is directed to "protect and/or manage habitat to ensure the continued existence" of the Kentucky crayfish. Specifically, the plan calls for the protection of all pool/riffle complexes in streams known to contain the species from activities that may result in habitat degradation.

In Kentucky, 99.9% of the Kentucky crayfish's known range falls within private ownership. Since the species occurs in streams and rivers that flow over approximately 1050 sq. miles of land in six counties, it is not possible to list all of these private entities. The only known population of the Kentucky crayfish that occurs on publicly held land inhabits approximately 7.2 river miles of the Tradewater River that flows through the Pennyrile State Forest in extreme northwestern Christian Co. This State Forest is owned by the Commonwealth of Kentucky and the habitat receives some protection under the Kentucky Forest Conservation Act. Under that Act, activities must maintain at least a 50% overstory over perennial streams and leave intact a 25 foot riparian strip on slopes less than 15% and 55 feet on slopes greater than 15%.

No populations of the Kentucky crayfish fall within the Hoosier National Forest.

PAST AND CURRENT MANAGEMENT AND CONSERVATION ACTIVITIES

Other than the habitat protection measures listed above under **LAND OWNERSHIP AND EXISTING HABITAT PROTECTION**, the only other known conservation activities directed towards the Kentucky crayfish comes from its listing as Endangered under the Illinois Endangered Species Protection Act (IESPA). The IESPA prohibits the possession, taking, transportation, sale, offer for sale, or disposal of any listed animal without a permit issued by the Illinois Department of Natural Resources (IESPB, 1999). These protective measures apply to both private and governmental parties and are only afforded to Illinois populations of the species.

MANAGEMENT AND RESEARCH PRIORITIES

Management

Continued protection of existing suitable habitat for the Kentucky crayfish should be a management priority. Decreased water quality from siltation and toxic substance runoff may adversely affect the species. Management activities within the watersheds known to contain the Kentucky crayfish must minimize or eliminate: 1) the impoundment of flowing streams, 2) the instream removal of gravel/cobble substrates and woody debris, and 3) the input of runoff from agricultural and industrial activities.

A prudent management activity would also be to discourage the use of crayfish as bait and ban the interbasin transfer of aquatic species on publicly owned property. The effects of non-native crayfishes are well documented and the introduction of a species such as the rusty crayfish into the narrow range of the Kentucky crayfish in the Shawnee National Forest would have disastrous results.

Research

The Illinois populations of the Kentucky crayfish are separated from the bulk of the species known range in Kentucky by the Ohio River. The Ohio River has acted as a barrier to dispersal for several other species of *Orconectes* (*O. bisectus*, *O. margorectus*, and *O. tricuspis*) that occur in western Kentucky but not southern Illinois or Indiana. An analysis of the level of genetic variation within the range of the Kentucky crayfish is therefore suggested. A study of this type would determine if the southern Illinois populations of *O. kentuckiensis* are genetically distinct from Kentucky populations and would thus require an increased level of conservation recognition.

It is also suggested that continued monitoring of the Kentucky crayfishes' distribution and status be conducted. Monitoring activities should involve continued sampling of historical localities to determine if local populations are persisting and what, if any,

threats are pressuring those populations. Field sampling of historical sites would provide the first warning of non-native crayfish introductions.

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